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(54) Artificial horizon display

(57) The display comprises two screens (e.g. liquid crystal displays) superimposed. First screen (10) has triangular segments arranged in co-ordinate pairs and activatable between two visual conditions. Activation of a pair of segments provides an indication of aircraft attitude in roll. Second screen (11) arranged in front of screen (10) has horizontal segments activatable to define an area through which the visual condition of first screen (10) segments may be viewed to provide an indication of attitude in pitch.

The display is intended as a simple, artificial display of horizon for use when primary display, such as display based upon a multifunction CRT, has failed.

Fig.1.

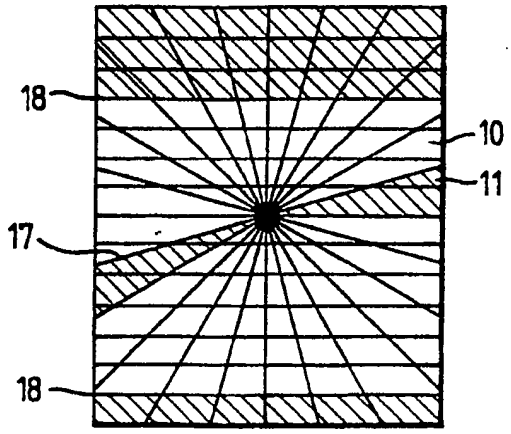

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Fig.1.

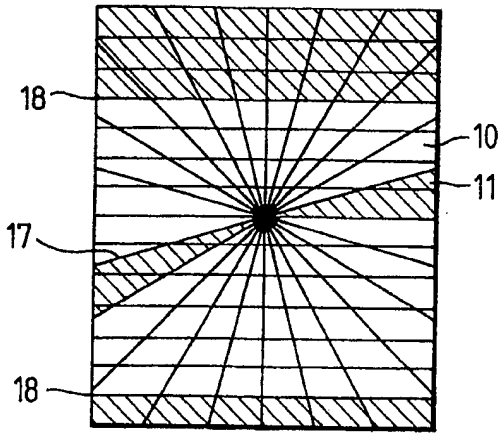


Fig.2a.

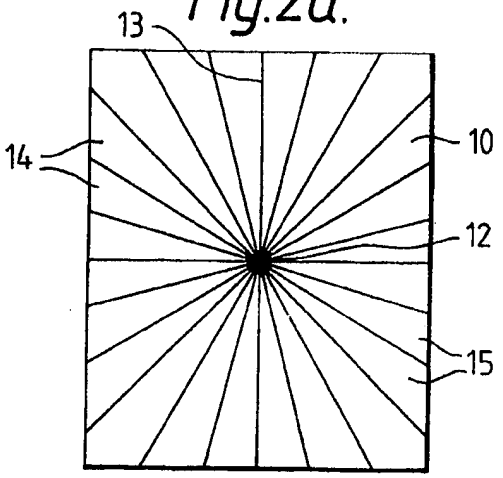
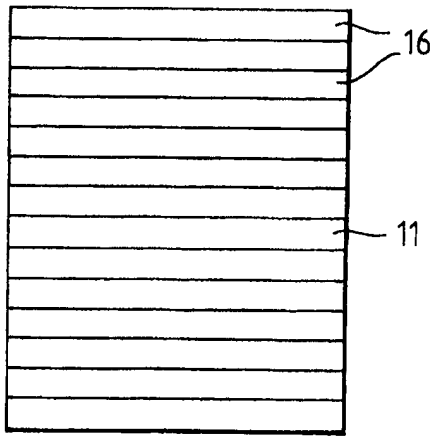


Fig.2b.



SPECIFICATION

Artificial horizons

The present invention relates to artificial horizons as used in aircraft.

An artificial horizon is one of the more important instruments provided in an aircraft to assist a pilot in controlling the aircraft, especially in situations, such as when flying in poor visibility, when he cannot view a true horizon. An artificial horizon gives a display analogous to the aircraft orientation in pitch and roll relative to the true horizon. Early artificial horizons had a horizon bar driven by a gyroscopic system which remained fixed in space, the bar moving over a display face including a symbol representative of the aircraft containing the instrument.

Recently aircraft cockpit instrumentation has increasingly made use of Cathode Ray Tube (CRT) displays. Such displays are being used to display a plurality of instrument readings including the artificial horizon. The artificial horizon display is still generated by a gyroscope, but a laser gyroscope rather than the conventional mechanical gyroscope may be used.

Use of a CRT display has the disadvantages that it requires a comparatively large cockpit volume to install Cathod Ray Tubes and that a Tube fault causes the loss of a plurality of instrument displays. There is therefore a requirement for standby displays of some of the more important instruments such as the artificial horizon.

Another recent trend in aircraft instrumentation is the development of solid state displays using devices such as light emitting diodes and liquid crystals. An artificial horizon display using a matrix of light emitting diodes or other solid state elements has been proposed. This display, however, requires so many elements with their associated drive circuits that it is inordinately expensive and complicated for use as a standby.

This invention provides an artificial horizon display, suitable for use a standby.

According to the present invention an artificial horizon display includes two screens superimposed one over the other, a first screen having a central point with triangular segments radiating therefrom, the segments being such that one side of each co-ordinates with a side of a radially opposed segment to form a straight line, and a second screen having a series of horizontally extending segments, each segment being capable of activation between two contrasting visual conditions, the foremost screen as viewed being such that in at least one of the visual conditions of its segments the visual condition of the sub-imposed rearmost screen can be seen therethrough.

Preferably both screens are rectangular and at least one has liquid crystal segments.

Further according to the invention an artificial horizon includes attitude sensing means for activating triangular segments in pairs to indicate an attitude in roll and for activating horizontal segments to vary the position of the area through which the triangular segments can be viewed, so indicating an attitude in pitch.

One embodiment of the invention will now be described, by way of example only, with reference to the accompanying diagrammatic drawings, of which,

Figure 1 shows an artificial horizon display according to the invention, and

Figures *2a, 2b* show the screens forming the display.

An artificial horizon display (Figure 1) in an aircraft (not shown) has two rectangular screens, a first screen 10 (see also Figure *2a*) and a second screen 11 (see also Figure *2b*) superimposed one over the other. The first screen 10 has a central point 12 which is the apex of a plurality of triangles, 14 to one side of a vertical 13 of the screen and 15 to the other side of the vertical. Each triangle 14, 15 is a liquid crystal, and triangles 14, 15 are so arranged that sides extending from the apex 12 form a series of diagonals.

The second screen 11 has a plurality of parallel horizontal liquid crystal strips 16.

In use, the display is illuminated by a light source, preferably from behind. Each liquid crystal 14, 15, 16 is connected to an activating unit (not shown) which varies a voltage across the crystal and which is driven by an attitude sensing device such as a gyroscope (not shown). Liquid crystals 14, 15 in screen 10 are activated in pairs, in response to changes in bank attitude of the aircraft, so that a diagonal 17 (Figure 1) is brought into contrast on the display face and approximates to the angle of the true horizon relative to the aircraft. Liquid crystals 16 in screen 11 are activated in pairs, a crystal at the top of the screen being activated as one at the bottom is deactivated or vice versa, in response to changes in pitch attitude of the aircraft. Liquid crystals 16 in screen 11 are so switched as to define an area, as indicated between limits 18 in Figure 1, which appears to an observer as the display. The position of the central point 12 of screen 10 in this display is an indication of the aircraft attitude in pitch relative to the true horizon. Figure 1 shows the display as indicating an aircraft banked to the right and nose down.

Liquid crystals 16 are preferably of the type which are translucent in the off condition and which are light absorbing in the on condition. When this is the case screen 11 is preferably the nearer screen to the observer. Liquid crystals 14, 15 are preferably of the type which change colour when activated.

The use of attitude sensing devices to drive displays (for example, CRT displays) is well known and documented. Likewise many liquid crystal materials and their properties, and methods of activating them, are well known and documented. These aspects, which are incidental to the present invention, are therefore not herein described in detail.

It will be realised that variations of the display as illustrated and described are possible within the

scope of the invention. For example, the display is illustrated as having only one each of strips 14, 15 activated. In practice it may be preferable to have many or all strips 14, 15 below the horizon line 17 activated.

This display will inevitably operate in a series of steps and can only approximately indicate an aircraft's attitude. The degree of "jerkiness" in movement of the display can be reduced, and the accuracy increased by increasing the number of liquid crystals 14, 15, 16. However, the greater the number of liquid crystals 14, 15, 16 the greater the complexity of the activating means.

Whilst the invention has been illustrated and described as having two screens 10, 11 both formed from liquid crystal segments, alternative arrangements are possible. For example the second screen 11 might have strips 16 formed from light emitting diodes. With this arrangement the screen 11 should be the rearmost (with respect to a viewer) strips 16 between limits 18 being caused to emit light.

CLAIMS

1. An artificial horizon display including two screens superimposed one over the other, a first screen having a central point with triangular segments radiating therefrom, the segments being such that one side of each co-ordinates with a side of a radially opposed segment to form a straight line, and a second screen having a series of horizontally extending segments, each segment being capable of activation between two contrasting visual conditions, the foremost screen as viewed being such that in at least one of the visual conditions of its segments the visual condition of the sub-imposed rearmost screen can be seen therethrough.

2. An artificial horizon display as claimed in claim 1 and wherein both screens are rectangular.

3. An artificial horizon display as claimed in claim 1 or claim and wherein at least one of the screens has liquid crystal segments.

4. An artificial horizon display as claimed in claim 1, 2 or 3 and including attitude sensing means for activating triangular segments in co-ordinate pairs to indicate attitude in roll.

5. An artificial horizon display as claimed in claim 1, 2, 3 or 4 and including attitude sensing means for activating horizontal segments to vary the position of the area through which triangular segments can be viewed, so indicating attitude in pitch.

6. An artificial horizon display as claimed in any preceding claim and illuminated from behind.

7. An artificial horizon display as claimed in any preceding claim and wherein all segments below the indicated horizon are activated.

8. An artificial horizon display substantially as herein described with reference to the accompanying drawings.

9. An aircraft or aircraft simulation including an artificial horizon display as claimed in any preceding claim.

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